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FERTILIZER

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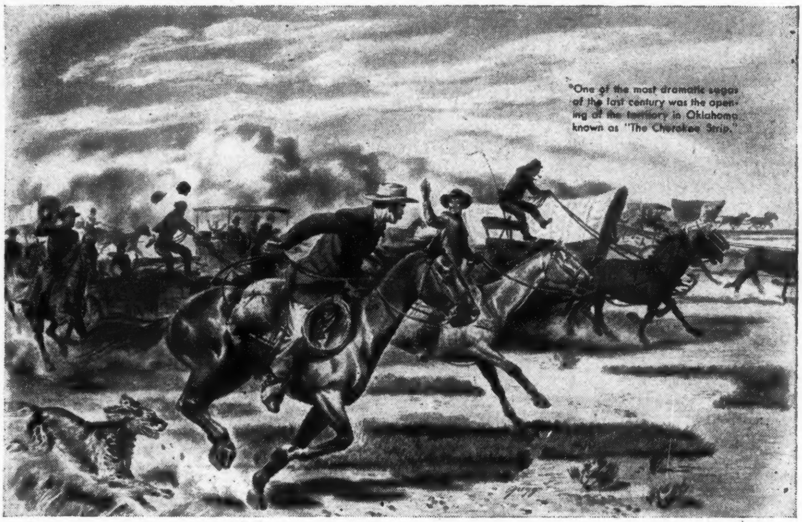

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The American FERTILIZER

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World Soil and Fertilizer Resources in Relation to Food Needs*

By ROBERT M. SALTER

Chief, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

Hunger and starvation have stalked the footsteps of man since the dawn of history. Only with the bloom of modern science in the last half-century has there come, for the first time, hope that these gaunt spectres could at last be banished, if man but willed it so. Through the centuries those in positions of leadership have been prone to accept the misery of hunger as an unavoidable fact of life, the result of population pressure on a limited food supply.

In the midst of the most destructive war in history, the leaders of the Allied Nations determined that one of the goals of victory should be *freedom from want.* To some, science appears to offer a basis of fact for this ideal. Here, in our own country, farmers applied the results of agricultural research so efficiently during the war years that production of food crops—despite many difficulties—reached and held an unprecedented peak. And it seems reasonable that with the peace, benefits of agricultural research might be still further extended, and that all the people of the world might possibly be better fed.

The high ideals that came with the fervor of the war are now being reconsidered and evaluated coolly in the light of peace-time realities. The peoples of the warring nations are determined to be practical. With skeptical minds they are asking: Is it, after all, reasonable to hope that the world can produce enough to feed all its human inhabitants? Can the world's soil grow all the crops that would be needed? Are fertilizer sources great enough? Do we have the technology and management ability to produce the crops and maintain the soils?

These questions do not encompass the whole problem by any means, but these are the questions I am asked here today. I am glad to try to answer them, for I am convinced that we do have the soils we need, we do have the fertilizer resources, we have available the management ability, and we could produce enough food for all.

But how much is enough? We have an answer suitable for our purpose from the recent "World Food Survey" made by the Food and Agriculture Organization of the United Nations. By 1960, if everyone is to have an adequate diet, the world will need, according to the estimates of this survey, the following increases beyond pre-war production: Cereals, 21 per cent; roots and tubers, 27 per cent; sugar, 12 per cent; fats and oils, 34 per cent; pulses and nuts, 80 per cent; fruits and vegetables, 163 per cent; meats 46 per cent; and milk, 100 per cent.

Considering only the natural physical resources needed to obtain these increases in food production, and with acute awareness of many other problems involved, there are two obvious courses we can follow in seeking higher

*An address before the American Association for the Advancement of Science, Boston, Mass., December 30, 1946.

food production the world over. First, and perhaps as the easier course, we could obtain much of the increase through more intensive and more efficient use of the land now farmed. Second, with our knowledge of world soil types, we could expand production in the areas having undeveloped soil resources. I shall discuss these two courses separately and in the order named.

More Intensive Cultivation

Some of the possibilities of intensive and efficient production are readily evident in our own war experiences. Production of food crops was maintained at about 35 per cent above the period 1935–39. Admittedly, weather was more favorable in the war years than during the pre-war years, but even so with no more favorable weather the production would have been 20 per cent greater, despite the fact that the labor force was actually 6 per cent smaller.

Our experiment stations and our more successful farmers provide many illustrations of the opportunity for increasing food crop yields and animal production, if these improved agricultural techniques were more widely applied. Thus, the limiting factors to increased production seem to be lack of education and lack of capital rather than any limits of physical production capacity. For example, recent experiments on corn culture in the Southeast under ordinary farm conditions show that corn yields for that area can be more than doubled by a combination of improved practices. In addition to regular fertilization practices, these include heavy nitrogen treatment combined with the growing of adapted hybrids, closer spacing to take advantage of heavier fertilization, and early and shallow cultivation for weed control. By 1960, perhaps, 50-bushel-per-acre corn production in the Southeast will be the rule rather than the exception as today.

This, and many other examples, would indicate also that the estimates of production possibilities after the war, under prosperity conditions, made cooperatively by the United States Department of Agriculture and the Land Grant Colleges, are really conservative, though they may appear somewhat optimistic. This study estimated that there can be readily attained by 1950 appreciable increases in production per acre of most of our principal crops, over that obtained in the 1935–39 period. These estimated increases were as follows: Corn, 31 per cent; hay, 28 per cent; wheat 18 per cent; rice, 13 per cent; peanuts, 20 per cent; sugar beets, 17 per cent; potatoes, 22 per cent; and sweet potatoes, 31 per cent.

But the United States alone cannot feed the hungry of the world. We must look to other countries also to intensify food production, preferably in the food-deficit areas. Europe, with the exception of Poland, Russia, and the Balkans, had reached a high degree of intensified farming in relation to its soil recources prior to the war. Significant increases in the more highly developed European countries are thus doubtful. If, however, we take into account yield increases readily attainable in different soil regions of the United States, we can safely predict yield increases in other countries that possess the same Great Soil

TABLE I

Estimated Attainable Increase in Yield Due to Improved Practices.

U. S. S. R.

Crop	Yield	
	1935–39 (bu.)	1960 (bu.)
Wheat	10.0	12.0
Rye	12.7	13.5
Corn	16.3	20.0
Oats	22.2	28.0
Barley	4.9	18.0
Sugar Beets	6.1 T	8.0 T
Potatoes	121.5	180.0

INDIA

Crop	Yield	
	1935–39 (bu.)	1960 (bu.)
Wheat	10.7	20.0
Rice	26.2	40.0
Corn	12.9	20.0
Barley	16.5	20.0
Peanuts	400.0 lbs.	600.0 .bs.

CHINA

Crop	Yield	
	1935–39 (bu.)	1960 (bu.)
Wheat	14.9	18.0
Rice	52.5	70.0
Corn	24.2	35.0
Barley	21.8	24.0
Peanuts	769.0 lbs.	1,000.0 lbs.
Soybeans	16.8	20.0
Dry Beans	730.0 lbs.	1,000.0 lbs.
Potatoes	100.0	150.0

UNITED STATES

Crop	Yield	
	1937–41 (bu.)	1950 (bu.)
Corn	28.1	36.7
Oats	31.7	38.5
Hay	1.4 T	1.8 T
Potatoes	124.0	152.0
Soybeans	18.5	21.9
Peanuts	765.0 lbs	916.0 lbs
Wheat	12.4	14.6
Rice	47.5	53.6

Groups. In Table I we have such predictions for China, India, and the Soviet Union, the world's three most populous countries. These predictions take into account the present reported average yields in these countries and also the general intensity of present cropping practices, insofar as they are known. Yield increases considered attainable in these countries by 1960 are substantially equivalent to those considered attainable in the United States by 1950, as reported in the U. S. Department of Agriculture's Miscellaneous Publication No. 593, "Peace-time Adjustments in Farming."

It is impossible with the data available to make predictions on possible production increases by individual crops the world over, because acreage, yield, and production of many important crops are not reported by all countries. Also, much of the world's food supply comes from animal products and the efficiency of this production in different countries is not known. But we can estimate probable increase in world production of the eight principal classes of food, by applying to each class the percentage increases of about the same magnitude of those thought attainable for principal crops in the United States by 1950. Thus, in Table II we have the estimated world food supply possible in 1960 as a result of more intensive and better farming methods on present crop land, compared with the supply needed in 1960 to give all the people of the world an adequate diet, as estimated in the FAO survey.

In arriving at these estimates it is necessary to assume that the total pre-war world food supply equaled pre-war food consumption. Pre-war world food supplies were, therefore, estimated by multiplying per capita consumption, as reported in the FAO survey, by world population. Larger percentage increases were applied to roots and tubers and fruits and vegetables because of the apparent opportunity for greatly increasing yields of these crops by the generous use of fertilizers.

On the basis of these estimates, world food needs in 1960 could be met for sugar and for roots and tubers on existing crop land. The need for cereals could virtually be met. Production of all other classes of food would fall short of the need.

It should be borne in mind, however, that the increases assumed to be attainable on existing crop land are conservative. There seems little doubt that a general use of high rates of fertilization on soils that will respond, coupled with modern techniques of insect and disease control, a change in land use patterns, selection of best varieties, flood and erosion control, and the adoption of other lesser techniques would result in even larger increases.

New Land In Cultivation

There are even greater opportunities—but more difficulties perhaps —in increasing food production by bringing new lands into cultivation. At present only 7 to 10 per cent of the total world land area is cultivated. Except for some desert areas, perpetual snow and ice, tundra, and the most rugged mountains, there is virtually no limit to the amount of land that can be brought into cultivation, save the economic limits of costs and returns. When we consider the Great Soil Groups of the world and the relatively small extent to which some of them are already in cultivation these possibilities become more apparent.

Soil maps have been made of many parts of the world. During the past few years our Bureau has made serious attempts to assemble these into a series of maps of uniform nomen-

TABLE II

PRE-WAR FOOD PRODUCTION AND INCREASES ATTAINABLE FROM MORE INTENSIVE USE OF PRESENT CROP LAND[1]

	Cereals	Roots and tubers[2]	Sugar	Fats and oils	Pulses and nuts	Fruits and vegetables[3]	Meat	Milk
	(millions of metric tons)							
Pre-war production	300.4	153.2	30.0	15.2	36.2	156.3	65.6	150.2
Increase attainable from present crop land	20%	50%	15%	20%	20%	35%	20%	20%
Attainable production from present crop land	360.0	230.0	34.5	18.0	43.4	211.0	78.7	180.2
World food needs in 1960	363.5	194.5	33.6	20.4	65.2	411.0	95.8	300.0

[1]For 70 countries including 90 per cent of world population. World consumption of each class of food as given in "World Food Survey" of FAO is assumed to equal world production.
[2]Include bananas.
[3]Include eggs and fish.

clature so that various regions can be compared, and to fill in unmapped portions through careful study of climatic, geological, and other relevant data. This research is in progress. Although uncompleted, it has given soil scientists an opportunity to arrive at a few preliminary judgments about our soil resources. A very small scale, exceedingly generalized map of the world, compiled some time ago, may be useful to indicate the location of the food soil area of the world. (Fig. 1.)

The snow and ice, tundra, mountains, and deserts total 48 per cent of the world land areas. We can assume that these areas have no practical possibilities for extension of agriculture. The Chernozem, Chestnut, Gray Forest, Podzol (including Gray-Brown podzolic), the Red soils of tropics and subtropics, and Alluvial soils occupy an estimated 52 per cent of the world land area. In this 52 per cent we can look for areas for expansion of agriculture. The Chernozem and Chestnut soils are now largely under cultivation, and no great expansion into new areas can be foreseen. Some reclamation of Alluvial soils, either by drainage or irrigation or both, should be possible in the tropics.

PRASSOLOV (PEDOLOGY, NO. 2, 1946) ESTIMATES THE AREAS OF THE WORLD IN TEN BROAD CLASSES OF SOILS. HIS ESTIMATES ARE AS FOLLOWS:

Chernozems Chernozem soils of praries Black soils of tropical regions	6%
Chestnut soils of dry steppes, (including Solonetz)	7%
Gray Forest Brown Forest Slightly leached soils of dry forests	7%
Alluvial soils, marshes, and swamps of tropical regions	4%
Podzols (including bogs)	9%
Red soils of subtropics Reddish-brown soils of tropical savannas Red soils of tropical forests Lateritic soils	19%
Sierozems and other soils of desert steppes and oases (inc. Solonchaks) Sands and stony soils of the deserts	17%
Mountain Tundra Mountain Meadows Mountain-forest Podzols Mountain-forest Brown Soils Mountain-forest Red soils Soils of mountain steppes High mountain deserts	16%
Tundra	4%
Everlasting snow and ice	11%

The Podzols of the northern temperate zone and the Red soils of the tropics and subtropics constitute the extensive soils onto which great expansion of food production might be possible. These soils occupy an estimated 28 per cent of the world land area, and probably less than 1 per cent is now under cultivation. It is

(Continued on page 26)

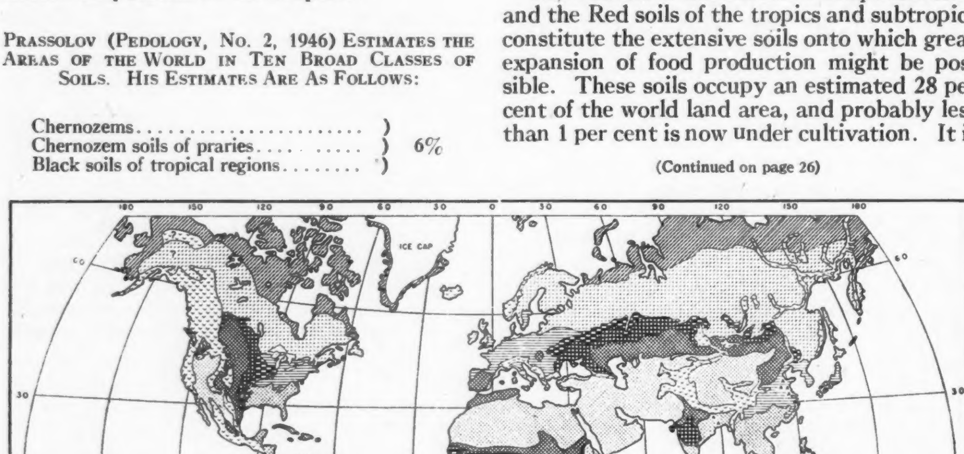

Fig. 1. Schematic Map of Important Soil Groups

International Reports Good Year

"In its first complete year of peace-time operations since 1941, International Minerals & Chemical Corporation has enjoyed a period of marked progress and accomplishment," Louis Ware, president of the company, said recently in a year-end review.

"Fortunately," he continued, "our business was not of a type that had to be re-geared to peace-time operations following its tremendous production for war. Of course, during the war, we, like other forward looking industrial concerns, made plans to take up any post-war production slack which might occur, but we were confident that the broad educational work being done to make food producers conscious of the value of plant foods in increasing crop production would result in continued high consumption of fertilizer after the war. This confidence has been justified. Our potash, phosphate and fertilizer plants have been operating at full capacity in 1946 and we see no slackening of this activity in prospect during the coming year.

"In 1946 our company launched two of the largest construction projects in its history, the Noralyn phosphate plant near our Peace Valley mine at Bartow, Fla., and a $3,000,000 amino products plant at San Jose, Calif. In addition, we completed construction of a superphosphate plant at Mason City, Iowa.

"The Florida and California plants will be completed during 1947, and we confidently expect to initiate other large construction projects this year to further add to the expansion of our entire operation.

"Present indications are for an unprecedented demand for phosphates, which completion of the Noralyn plant will help meet; and completion of the amino products plant at San Jose should give us a quantity of mono sodium glutamate to supply a demand that never before has been filled.

"We have recently established a wholly-owned subsidiary in England to represent us in the foreign export sales market, a phase of our business that was interrupted by the war but which can now be resumed.

"New financing initiated during 1946 has resulted in an increased number of stockholders and a broader distribution of our securities throughout the United States. Consequently, we have put a plan in force for regional stockholders meetings, and meetings we have held so far have been considered a valuable contribution to our stockholder relations," Mr. Ware concluded.

Captain Totman Returns

Captain James C. Totman, U.S.A.R., son of James E. Totman, president of the Summers Fertilizer Co., Inc., arrived on the *Queen Elizabeth*, New York, January 1st, with his bride, the former Monique Maljean, daughter of M. E. G. Maljean, head of the French Economic Commission to Austria. The marriage took place in Versailles, December 23rd. The couple will reside at Watkins Glen, New York, while Captain Totman completes his college training at Cornell, following which he will become associated with the Summers organization.

Effect of 2,4-D on Soil Micro-organisms

The widespread use of 2,4-dichlorophenoxyacetic acid as a weed killer makes it desirable to know more about its effect upon all kinds of organisms. Because most of the 2,4-D which is sprayed ultimately reaches the soil, it is especially desirable to know what effect it may have on the useful and harmful micro-organisms of the soil.

In the November, 1946, Michigan Agricultural Experiment Station Bulletin, Ralph W. Lewis and Charles L. Hamner report on experiments carried on by the station with several commercial preparations of 2,4-D weed killer. While saturated solutions containing up to 4,000 parts per million of 2,4-D inhibited the growth of some of the soil organisms, a concentration of 1,000 p.p.m. in no case had any harmful effect.

From this they conclude that "under normal rates of application for the killing of weeds, the amount of 2,4-D which reaches the soil will have no important effect on the soil micro-organisms or on plant pathogenes present in the soil."

Heavy Fertilization Pays

High fertilization is more profitable than low fertilization. This was revealed by experiments conducted by Michigan State College soil specialists. In experiments conducted to show the value of alfalfa as a soil builder when followed by other crops, such as corn and beets, part of the plots were fertilized with 1,000 pounds per acre of commercial fertilizer, and others with 400 pounds. The high fertilization produced an average of $28.03 more cash returns per acre than the other, or $16.06 above the cost of the extra 600 pounds of fertilizer.

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Principal Articles in This Issue

Record Crop Yield In 1946

The total output of crops in 1946 is the greatest in the history of our country. High yields are primarily responsible, although the harvested acreage is fairly large, and the growing season has been more favorable than usual. The aggregate volume of crops is 26 per cent above the 1923–32 (pre-drought) average, 2 points above the previous record production in 1942 and 7 points above that of last year. Not only the quantity but also the quality of crops is outstanding.

Production of individual crops reflects the generally favorable growing conditions. A 3.3-billion bushel corn crop of excellent quality tops any previous crop. For the third successive year more than a billion bushels of wheat were harvested, production this year breaking all previous records. Rice, soybeans and cherries set new marks in the final harvest returns to join potatoes, tobacco, peaches, pears, plums, and truck crops. Crops with near-record production are oats, peanuts and grapes. Better than average crops of hay, sorghum grain, popcorn, dry peas, sweetpotatoes, apples, prunes, apricots, hops, sugarcane and sugar beets were harvested. Cotton and cottonseed production, however, is about one-third below average and, with the exception of 1921, the smallest since 1895. Other crops falling below average are barley, flaxseed, buckwheat, rye, broomcorn, dry beans, cowpeas, pecan sand maple products

In 1946 the harvested acreage for 52 crops amounted to nearly 346 million acres. This total is slightly smaller than in any of the preceding three years, larger than in any year from 1933 to 1942, but substantially below the 1929–32 level of 355 to 362 million acres. Total acreage changes vary significantly by geographic regions. In 1946 the South Atlantic region harvested the smallest aggregate acreage in the 18 years of record. The South Central region is virtually at the record low level of 1945. The Western region has never harvested a larger acreage. The North Atlantic region is only slightly below the peak total of 1935. The North Central region, which usually accounts for more than half of the total harvested acreage of the country, was within 2 per cent of the 1930 peak of 198.6 million acres. In 6 States—Vermont, Illinois, Michigan, Idaho, Oregon and California—the 1946 harvested acreage tops that of any previous year. Harvested acreages were significantly below the high totals of the early Thirties in the Great Plains States, but this was not so much due to acreage losses as to

larger proportion now summer-fallowed and pastured.

PRODUCTION (in thousands)

CROP	Unit	Average 1935–44	1945	1946
Corn, all	Bu.	2,608,499	2,880,933	3,287,927
Wheat, all	Bu.	843,692	1,108,224	1,155,715
Winter	Bu.	618,019	817,834	873,893
All spring	Bu.	225,673	290,390	281,822
Durum	Bu.	31,900	32,840	35,836
Other spring	Bu.	193,774	257,550	245,986
Oats	Bu.	1,129,441	1,535,676	1,509,867
Barley	Bu.	289,598	266,833	263,350
Rye	Bu.	42,356	23,952	18,685
Buckwheat	Bu.	7,138	6,644	7,105
Flaxseed	Bu.	23,426	34,557	22,962
Rice	Bu.	55,257	68,150	71,520
Popcorn	Lb.	116,300	427,780	266,752
Sorghums for grain	Bu.	86,543	97,014	106,737
Sorghums for forage	Tons[1]	12,012	9,816	8,619
Sorghums for silage	Tons[2]	5,184	3,622	3,701
Cotton, lint	Bales	12,553	9,015	8,482
Cottonseed	Tons	5,240	3,664	3,452
Hay, all	Tons	91,306	108,539	100,860
Hay, wild	Tons	10,616	13,250	11,530
Alfalfa seed	Bu.	1,176	1,182	1,658
Red clover seed	Bu.	1,314	1,750	2,113
Alsike clover seed	Bu.	304	351	390
Sweetclover seed	Bu.	883	606	616
Lespedeza seed	Lb.	143,169	187,000	213,900
Timothy seed	Bu.	1,783	1,333	1,398
Sudan grass seed	Lb.	57,514	29,100	23,000
Beans, dry edible	Bags[3]	16,408	13,083	15,797
Peas, dry field	Bags[3]	4,580	5,915	6,926
Soybeans for beans	Bu.	103,457	192,076	196,725
Cowpeas for peas	Bu.	6,591	3,790	3,222
Peanuts picked and threshed	Lb.	1,587,964	2,042,235	2,075,880
Velvetbeans	Tons	850	525	433
Potatoes	Bu.	372,756	418,020	474,609
Sweet potatoes	Bu.	66,422	64,665	66,807
Tobacco	Lb.	1,479,621	1,993,837	2,235,328
Sorgo sirup	Gal.	12,213	9,850	12,074
Sugarcane for sugar and seed	Tons	5,873	6,718	6,418
Sugarcane sirup	Gal.	20,625	28,711	24,450
Sugar beets	Tons	9,568	8,626	10,666
Maple sugar	Lb.	643	237	372
Maple sirup	Gal.	2,625	991	1,328
Broomcorn	Tons	44	39	44
Hops	Lb.	39,631	56,772	53,171
Flax fiber (Ore.)	Tons	13	12	14
Apples, commercial crop	Bu.	120,962	68,042	121,520
Peaches, total	Bu.	59,938	81,564	86,448
Pears, total	Bu.	29,002	34,011	35,488
Grapes, total	Tons	2,553	2,792	2,851
Cherries (12 States)	Tons	160	148	215
Apricots (3 States)	Tons	236	194	343
Plums (2 States)	Tons	74	73	105

PRODUCTION (in thousands)

Crop	Unit	Average 1935–44	1945	1946
Prunes, dried (3 States)	Tons	210	234	214
Prunes, other than dried (3 States)	Tons	81	110	125
Oranges (5 States)	Boxes	81,450	104,520	125,430
Grapefruit (4 States)	Boxes	40,083	63,550	67,320
Lemons (Calif.)	Boxes	11,520	14,500	13,900
Cranberries (5 States)	Bbl.	624	657	846
Pecans (12 States)	Lb.	105,746	138,082	77,155
Tung nuts (5 States)	Tons	12	37	47

[1]Dry weight.
[2]Green weight.
[3]Bags of 100 pounds (uncleaned).

Bemis Calendar for 1947

A 1947 wall calendar, 15"x32", is being distributed by Bemis Bro. Bag Co. Printed in dark brown on a pale green background, each of the twelve pages features the current month, supplemented by the preceding and the following month.

At the top of each page is a large photograph. Twelve different operations in the manufacture of burlap, cotton and paper bags are featured. Large bold print makes this calendar easy to read, and the photographs are both attractive and educational.

Copies of this calendar are available from any of the thirty-four offices of the Bemis Bro. Bag Co.

On Feeding Plants

According to "Nitrogen News and Views," Dr. W. A. Albrecht, University of Missouri, considers it essential that we increase the nutrient supply of most farm plants. He stated, "Breeding a plant that is able to tolerate starvation is about as impossible as maintaining a race of bachelors beyond the first generation. Although air and water plus sun energy, make up 95 per cent of the total weight of growing plants, the 5 per cent furnished by the soil determines the yield. Even in a year when weather conditions are almost perfect, yields may be low because the 5 per cent usually furnished by the soil is limiting the plant in utilizing the other 95 per cent. And remember, your plants aren't so fortunate as cattle; they can't break through the fence and go where there's more food."

Beers Appointed Secretary of Mid-West Soil Improvement Committee

Zenas H. Beers has been appointed Executive Secretary of the Middle West Soil Improvement Committee and assumed his new duties on January 1, 1947. He succeeds the late Leroy T. Goble, who died last July and who for nearly eight years had directed the committee's educational program.

Mr. Beers, who is 35, has had wide experience in agriculture, agronomy and public relations work. He has been a close student of soil conservation, is a graduate agronomist, has worked on farms and written extensively for leading publications.

For the past five and a half years, Beers has been bulletin editor and associate in extension information at Purdue University agricultural experiment station. Although the major portion of his work at Purdue has been the editing of publications, he has written numerous articles on experiments conducted by research men. With Glenn Sample, editor of the Hoosier Farmer, he devleoped a program to furnish that magazine with a page of experiment station news each month. This feature has proved highly popular with the magazine's readers.

Beers is a graduate of the University of Wisconsin, where he attended the College of Agriculture. He holds a bachelor's and master's degree in agronomy and agricultural journalism. While in school he was editor of the Wisconsin Country Magazine.

More Grass from Treated Pasture

Dr. W. L. Titsworth, who has an 84-acre farm in McCracken Co., Kentucky, with more than 40 head of dairy cows, told Farm Agent Joe Hurt that he had an accumulation of pasture, despite the fact 16 acres were in corn and 12 acres had been cut for hay. During the past four years, Dr. Titsworth has improved his farm by applying three tons of limestone, 500 pounds or more of 20 per cent phosphate, 100 pounds of muriate of potash and 300 pounds of ammonium nitrate per acre. On a 20-acre field where there was already a good stand of grasses and legumes, he applied 300 pounds of ammonium nitrate to the acre early in the spring. Although it cost him $10 per acre, he said he made it back during the first 30 days in early grass for his cattle, thus reducing the amount of grass and hay he had been feeding.

New Prices On Arcadian Nitrate of Soda

The Barrett Division of Allied Chemical & Dye Corporation has announced new prices on Arcadian Nitrate of Soda for the period from January 1, 1947, to June 30, 1947. The price to fertilizer manufacturers is now $32.00 per ton in bulk, carload lots, f.o.b. Hopewell, Va. For shipment in 100-lb paper bags, an additional charge of $3.50 per net ton is made. Where tax tags are required, these are charged to buyer's account. The above prices are subject to change without notice.

Cal-Nitro Prices

Synthetic Nitrogen Products Corporation, New York, has announced that, beginning January 1, 1947, the price of Cal-Nitro (20.5 per cent N) in 100-lb. paper bags has been advanced to $33.00 per net ton, f.o.b. Hopewell, Va. This increase, which is an advance of 50 cents per ton, was due to the higher cost of bags and bagging. There is no change in the bulk price of $29.00 per ton, f.o.b. Hopewell, Va.

FERTILIZER MATERIALS MARKET

NEW YORK

New Year Finds Fertilizer Materials In Short Supply and In Heavy Demand. Price Increase In Nitrate of Soda and Triple Superphosphate. Foreign Materials Priced Too High for Local Interest. Contract Shipments Behind Schedule.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, JANUARY 6, 1947.

At the beginning of the new year, demand for all basic fertilizer materials is heavy and supplies in most cases are considerably short of meeting inquiry. At the close of the year inventories of all materials were comparatively low with production of both basic ingredients and complete fertilizers at record-high levels. The shortage of nitrogen in all forms remians the most serious problem affecting the industry, and information received from all sources indicates that a nitogen shortage will exist throughout the current fertilizer year.

Recent price increases to be noted are nitrate of soda, which has been advanced $3 a ton, and triple superphosphate, on which one major producer has advanced schedule to 71 cents per unit A.P.A. f.o.b. production point. It is expected that other producers will do likewise, thus reflecting recent increases of phosphate rock.

It is hoped that additional supplies of various fertilizer materials will be imported during 1947, but at the present time price ideas of foreign producers are delaying any trade in organics, potash and other materials. Export inquiry, particularly from South America, continues heavy and considerable quantities of superphosphate have been moved to that market.

Sulphate of Ammonia

The effects of the recent loss in production by the steel industry are still being felt, with shipments to fertilizer manufacturers in most cases behind schedule. Pressure from mixers is unabated, and demand unfilled.

Organic Materials

Buying activity has been confined mainly to feed manufacturers as prices remain beyond the reach of fertilizer mixers. All markets are extremely strong, with offerings definitely limited. Tenders of fertilizer bone meal from both Europe and South America have been in the market recently, with no takers at high asking prices.

Nitrate of Soda

The markets for both imported and domestic materials are extremely firm, with the tight supply situation of recent months continuing. Some increase in available supplies is expected in the near future.

Superphosphate

It is reported that some producers have advanced prices over recent levels, and if possible, this market has become even tighter, with demand continuing in excess of production capacity. Inquiry for triple superphosphate is exceedingly heavy at this time.

Phosphate Rock

Stocks at the end of the year were at extremely low levels, with acidulators taking all supplies when available. The price structure is very firm but some delays in shipments have been reported because of transportation shortages.

Potash

The situation in this market is similar to that of other fertilizer materials—i.e., production remains high and demand unsatisfied in many cases. The prospect of foreign potash to ease the domestic situation is not apparent at this time as production from the French and German mines is being consumed in Europe itself.

PHILADELPHIA

Demand for Materials Still Heavy. Higher Prices for Nitrate of Soda. Imcrease in Superphosphate Price Expected. Car Shortage Continues.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, JANUARY 6, 1947.

There is still no surplus of fertilizer materials. Inventories are said to be less than usual, with a strong demand for all materials and at increased prices. While a recent ar-

rival of urea from Germany created considerable interest in fertilizer circles. it is pretty well established that this will go into plastics —not fertilizer. The export demand for oil cake meals is exceedingly strong, and it is said the Department of Agriculture hesitates to grant permission to supply that demand in view of the scarcity of organics here. However, it is thought likely that something over one hundred thousand tons will be exported during the first three months of 1947.

Sulphate of Ammonia.—Market position is very tight with shipments said to be running behind schedule, and demand increasing.

Nitrate of Soda.—Demand is active and in excess of tight supply position. Prices have been advanced on both domestic and Chilean. The domestic price is nominally $32.00 in bulk, and $35.50 in 100-lb bags, f.o.b. producing plant in Virginia. The Chilean price is now $38.50 in bulk and $41.50 in 100-lb. bags, usual terms and conditions.

Castor Pomace.—No offerings reported, and shipments on contracts.

Blood, Tankage, Bone.—Despite slack feeding demand, recent offerings of these organics found fairly ready sale at recent price levels. There were sales ranging from $8.50 to $9.50 per unit of ammonia ($10.33 to $11.55 per unit N), and it is significant that quite a few of the sales were for fertilizer use. Steamed bone meal sold at $80.00 per ton, with the supply very scant.

Phosphate Rock.—The demand is far ahead of production capacity, and car shortage delays shipment of the supply that is available.

Superphosphate.—Contract renewals are said to be expected early this month, but no price announcements have been heard yet. Higher production costs justify an increase. Meanwhile the demand continues ahead of the supply.

Potash.—Market position continues tight with steady demand for more than can be produced. Shipments are moving on allocations. but scarcity of cars is causing considerable delay.

CHARLESTON

Heavy Deliveries of Mixed Fertilizers. Material Supplies Still Short and Hampered by Transportation Shortages.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, JANUARY 4, 1947.

Demand for all materials for fertilizer use remains strong as the fertilizer mixing season progresses. Car shortages are a large factor in holding up production. As the year ends a greater proportion of mixed fertilizers has been delivered to farmers than ever before for this time of the season.

Organics.—Organics in general remain high in price. Vegetable meals have firmed up slightly after breaking in the last few weeks. Seven per cent cotton seed meal is quoted around $73.00 to $74.00 and 8 per cent cotton seed meal about $81.00, bagged, f.o.b. Memphis for January shipment. Soya meal bagged is about $73.50, f.o.b. Memphis. South American packing-house products were shipped in only small quantity during December, due to export controls. Prices were above the domestic market which has recently sold dried ground blood at about $9.00 per unit ammonia, ($10.94 per unit N) f.o.b. Baltimore and Chicago. Ground packing-house tankage is quoted at about $8.50 per unit ammonia ($10.33 per unit N) and 10 cents per unit B.P.L. for prompt shipment, f.o.b. Chicago in bulk. Domestic nitrogenous is quoted from $6.00 to $4.50 per unit ammonia ($7.29 to $5.47 per unit N) f.o.b. production point, depending on production point. Supplies of this article are tight.

Castor Pomace.—Recently the market on

castor pomace has been quiet as producers move supplies against contracts.

Hoof Meal.—Price advanced 50 cents per unit of ammonia during last week of December and sellers hold to $9.00 ($10.94 per unit N), f.o.b. Chicago.

Blood.—Market rather firm with prices about same for last two weeks of December.

Nitrate of Soda.—Year ended with supply situation exceedingly tight. The price on domestic nitrate of soda as of January 1, 1947, will be $32.00 in bulk and $35.50 per ton in 100-lb. bags, carlots, f.o.b. Hopewell. Imports of soda have been delayed and demand remains far stronger than the supply. Domestic production has continuously been behind because of shortage of soda ash.

Sulphate of Ammonia.—Demand greater than supply and call increasing as the season progresses. Market exceedingly tight.

Ammonia Nitrate.—Stocks low and market tight as demand far exceeds supply.

Potash.—This article remains tight, with car shortages delaying shipments against allocations to customers.

Superphosphate.—Production quickly taken up by strong demand. Producers hampered by shortage of sulphuric acid and curtailed deliveries of rock caused by car shortages at the mines.

Phosphate Rock.—Prices remain firm and call from consumers greater than producers can supply with the present shortage of cars which is cutting deliveries by 35 to 40 per cent.

CHICAGO

Increase In Live Stock Does Not Increase Supply of Fertilizer Organics. Feed Material Prices Decline.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, JANUARY 4, 1947.

Offerings of organics are not improving, although inquiry is quite active. One would think the increase in receipts of live-stock would result in production of fertilizer tankage, but seemingly the little which is being made is being used by the producers and not put on the market.

In feeds, reduced quotations are in effect. Wet rendered tankage sales were about $7.00 per unit of ammonia ($8.51 per unit N), while blood was quoted at $8.00 per unit of ammonia ($9.72 per unit N) f.o.b. shipping point. Trading has been quiet with buying interest lacking.

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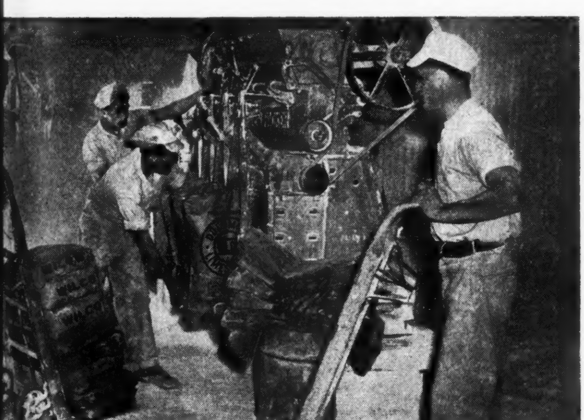

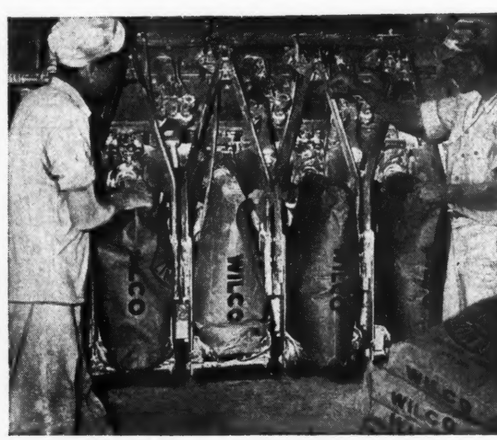

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Seed Bed Too Well Done Helps Weeds

The 200-year-old copy book maxim, "whatever is worth doing at all is worth doing well," may sometimes lead to doing some work too well to get the desired effect. Such an untoward result has come to some farmers who adopted the U. S. Department of Agriculture's new treatment for control of weeds in tobacco plant beds.

The method consists in treating the bed in the fall with calcium cyanimide and urea and then planting seed in it in the spring after working in fertilizer. This method, developed by scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering, in cooperation with State Agricultural Experiment Stations, has been used only two seasons and some of the farmers have reported a great many weeds in spite of the precaution. "Now," says Dr. E. E. Clayton, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, "we find that preparing the seedbed too deep brings up viable weed seeds from below after the killing power of the chemicals has disappeared." Their tests showed that in the top inch the treatment killed 96 per cent of the weed seeds; in the next inch layer the kill was 95 per cent; in the third inch it was 82 per cent; and in the fifth inch it was only 59 per cent. The seeds down three inches or more below the surface do not sprout unless brought to the surface.

Deep preparation has long been considered one of the marks of good farming, but following the general rule in this case resulted in defeating the object of the treatment by bringing viable weed seeds near to the surface.

The Department recommends that in working the fertilizer into the plant beds, which is done in the spring, the ground be stirred to a depth of one to one and a half inches only. Much more than that gets into the zone of considerable numbers of live seeds. The tobacco seeds, being almost dust fine, are sown on the surface.

Fertilizer Boosts Iowa Corn Yields

Barnyard manure, lime and potassium, coupled with good crop rotations, continue to offer the key to high Iowa corn yields on the basis of long-time studies of the Iowa Agricultural Experiment Station. The most recent results continue in line with previous 10-year observations. On Clarion-Webster soils a significant increase in all rotations, as well as

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on ground continuously in corn since 1915, was obtained by the addition of manure.

The ground continuously in corn yielded 29.8 bushels per acre in 1945 without manure and produced 55.2 bushels where 2 tons of manure were applied per acre.

In a corn, oats, clover rotation, the yield was boosted from 55 bushels to 78 by adding manure at a rate of 2 tons per acre per year. For corn, corn, oats and clover the yields were 55.4 without manure and 70.4 with the addition of 2 tons. Corn, corn, oats, clover, clover yielded 53.4 bushels, with 73.1 bushels resulting when manured.

With a rotation of corn, corn, oats and clover the addition of 150 pounds of 0–20–0 fertilizer, plus 2 tons of manure and enough lime to meet requirements, gave a corn yield of 77.7 bushels. When 200 pounds of 2–12–12 fertilizer were substituted for the 0–20–0, the yield was 85 bushels per acre, indicating the value of potassium as well as phosphate.

Using the same rotation and applications, except that no manure was applied, yields were 60 bushels with the 0–20–0 and 85 bushels with 2–12–12. Since the amount of nitrogen was slight, most of the 25.4 bushel increase can be attributed to the addition of potassium.—*Iowa Farm Science, Ames, Iowa.*

Use of Fertilizer Ups Apple Yields

Use of plenty of good fertilizer and other good orchard management practices have enabled a unit test demonstration farmer in Fannin County, Georgia, profit on his apple orchard when many other farmers in his section were not able to produce profitable apple crops. This farmer, J. W. Wilson, produced $200 worth of apples from one tree in his orchard in 1946.

Although the apple crop on the Wilson farm was damaged by weather early in the year, a 2,500-bushel crop was grown. This was the eleventh consecutive year that the Wilson orchard has returned a profit.

"I've been willing to spend some money every year to keep my trees in good condition," Mr. Wilson says. "It pays to spend $10 or $15 per tree for spray materials and fertilizer if that tree produces apples worth several times that much in the fall."

W. R. Mercier, Fannin county agent, points out that Mr. Wilson keeps detailed records on production and can point out a half-dozen trees that produced more than a hundred dollars worth of apples in 1946.

This apple grower is a great believer in fertilizer. Winter vetch now growing in the

orchard received 400 pounds of 4-8-6 fertilizer per acre when it was planted last fall Then, each spring Mr. Wilson applies 14 pounds of high-grade fertilizer under each tree. He scatters fertilizer on top of the ground under the branches of the trees and lets it soak into the land.

Lespedeza grows in the orchard during the summer and both summer and winter crops are turned under. Nothing is ever taken from the land but apples.

Each acre of land has had around four tons of lime applied during the past few years and also all the land has been treated with phosphate.

Many trees in the Wilson orchard have trunks as large as a man's body. Trees in a nearby orchard set out at the same time the Wilson orchard was started are about the size of a man's arm. The neighboring orchard was not fertilized.

Nitrogen Plus Phosphate Increases New Mexico Cotton Yields

A mixture of nitrogen and phosphate is the best fertilizer for irrigated cotton production in New Mexico, Glen Staten, associate agronomist at the state experiment station, said recently.

Staten declared that 22 tests on A & M College fields in the past 17 consecutive years have shown an increase of about one pound of lint cotton for every pound of mixed available nitrogen and phosphate applied to the soil.

Applied separately, though, neither nitrogen or phosphate was as effective as the two used together, Staten said. Each pound of available phosphate increased the lint yield by only four-tenths of a pound and each pound of available nitrogen increased the yield by only seven-tenths of a pound.

"For land producing one to one and one-half bales or less, the experiment station recommends 60 to 100 pounds of available nitrogen and 40 to 45 pounds of available phosphate per acre, depending on the past history of the field," the agronomist stated. "This will mean, for example, two sacks of 16–20–0 ammo-phos and one sack of ammonium nitrate or one sack of 11–48–0 ammo-phos and two sacks of ammonium nitrate."

Staten said that these mixtures are the ideal, but because of the present scarcity of fertilizers, farmers can only attempt to reach the required amounts of available plant food per acre. He advised farmers, for the time being, to apply fertilizer only to cotton land that produces less than one and a half bales an acre.

"Cost per pounds of available plant food, price of cotton, and expected returns per acre are factors that must be considered before applying fertilizer to cotton," the agronomist said. "The present approximate cost of nitrogen is from 10 to 13 cents per pound, phosphate six to eight cents per pound, and mixed fertilizers $8\frac{1}{2}$ to $13\frac{1}{2}$ cents per pound."

Fertilizers Boost Farm Incomes

In Cass County, Texas, wide interest is being attracted among neighbors of Farm Unit Demonstrators who are reporting that fertilization is boosting their farm incomes as much as 50 per cent over what they made before beginning the program.

Cass County Agricultural Agent E. M. Trew' Jr., bears out reports of the FUD successes, and points to Farm Unit Demonstrator Roy Melton, Cass County farmer, as a representative example. Since he launched a farm unit demonstration, Melton reports that his farm is making more money with no hired help than it formerly did when he kept two full-time hands working. Melton figures he nets half again as much profit from his farm by practic-

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ing FUD methods. As an example of how fertilization has paid off, Melton tells of the native meadow to which he applied 46 per cent superphosphate, 200 pounds to the acre, back in 1943. This year he cut four tons of hay per acre off the meadow, while an unfertilized check-plot nearby yielded only two and a half tons per acre.

Fertilizing Apples In Delaware

According to Delaware Extension Bulletin No. 45, apple trees require annual applications of a fertilizer containing nitrogen, phosphorus, and potassium such as a 10–6–4. Any grade of fertilizer which contains these three elements may be used. The rate of application is based on the nitrogen content. Each tree should receive at least 0.04 pound of actual nitrogen for each year of age until a maximum of 1 to 1½ pounds is being applied annually. Using a 10–6–4 fertilizer, this requires ⅓ to ½ pounds for each year of age of the tree until 10 to 15 pounds of a 10–6–4 are being applied annually to each tree. The fertilizer should be broadcast around the tree over an area slightly greater than the limb spread. Often it is desirable to apply part of the fertilizer in the fall and part in the spring. When this method is used, half may be applied in late September or early October and the other half in February or March. When all of the fertilizer is put on at one time, spring application is more desirable; however, fall application is necessary if the fertilizer contains cyanamide as a source of nitrogen.

The Utah Agricultural Experiment Station recommends the use of commercial fertilizer on winter wheat in the dry-land wheat producing areas of the state, at present prices. Tests have shown that nigrogen fertilizer gives increased yields or higher protein content, or both.

WORLD SOILS AND FERTILIZERS

(Continued from page 10)

recognized, of course, that a large proportion of these Podzols and Red soils are unsuitable for agriculture because of the unfavorable topography and stoniness.

The principal areas of Red soils are in Africa, South America, Southeastern Asia, including India, the Pacific Islands, and Southeastern North America. Most areas of Red soils are now in use in Southeastern Asia and India, and large areas are in use in some of the Pacific Islands and in the United States; but the resources of these soils are almost untouched in Africa and South America. If we assume that only 20 per cent of the Red soils of the tropics in South America and Africa alone were to be brought into production, about 900,000,000 acres would be added to the world acreage for food production. To these potential cultivated new areas of Red soils may be added a large area of uncultivated tropical soils found on the great islands of Sumatra, Borneo, New Guinea, and Madagascar. Assuming, then, that at least another 100,000,000 acres of Red tropical and Alluvial soils are available in these and other warm parts of the world, the total of one billion acres of tropical and subtropical soils may be used in calculating world soil potentialties.

The Podzols, located almost wholly in the north part of the northern hemisphere, are found mostly in Soviet Russia, Canada, and the United States. If we were to assume that only 10 per cent of these soils were brought into cultivation, another 300,000,000 acres would be added to world acreage for food production.

The world's uncultivated areas are, of course, generally less fertile than those already under cultivation. To maintain continued productivity these soils would need fairly heavy fertilization. The question of serious

erosion, especially in the tropical areas, need be met if there is expansion in this direction. In the last two decades, however, a body of science dealing with erosion control has been developed which gives us confidence that the problem could be met adequately. We could develop. We need not exploit.

If this huge body of 1,300,000,000 acres of new land were brought into production, what would be the world food picture? Again, without adequate production data we must estimate by making comparisons with production figures from similar areas. For estimating the possible production of the billion acres of tropical land we have chosen the Philippines as a yardstick because it is one of the few tropical countries that can be considered fairly representative of the tropical soil region, and that had even approximately complete food production records. Finland similarly was chosen as representative of the 300,000,000 acres available in the Podzol group. By applying the approximate production per acre of the principal classes of food obtained in the Philippines to the billion acres of tropical soils, and that obtained in Finland to the 300,000,000 acres of Podzol soils, we arrive at the data presented in Table III.

World food needs in 1960 could thus be met for all classes of food except meat, milk, and pulses and nuts, by production increases on present crop land acreage plus the production of one billion acres of tropical soils, if these soils were used as intensively and for the same classes of food products as the cultivated soils of the Philippines are now used. We could have more than enough cereals, roots and tubers, sugar, fats and oils, and fruits and vegetables. In addition, the need for pulses and nuts could be easily met or exceeded by shifting some of the production of coconuts from oil to edible nuts.

If production of 300 million acres of North Temperate Zone soils were added to the increase from the present crop land, and used as intensively and for the same classes of food products as the cultivated soils of Finland are used, the world food needs in 1960 would be met for cereals, roots and tubers, sugar, and milk, in addition, the need for fats and oils would be very nearly met.

World production from all our three sources combined—present world crop land, one billion

TABLE III

POTENTIAL FOOD PRODUCTION FROM MORE INTENSIVE USE OF EXISTING CROP LAND PLUS DEVELOPMENT OF ADDITIONAL LAND NOT NOW CULTIVATED

	Cereals	Roots and tubers	Sugar	Fats and oils	Pulses and nuts	Fruits and vegetables	Meat	Milk
	(millions of metric tons)							
Attainable production from present crop land	360.0	230.0	34.5	18.0	43.4	211.0	78.7	180.2
Attainable production from present crop land plus one billion new acres tropical soils[1]	717.5	469.5	177.5	69.5	55.4	470.0	89.4	188.8
Attainable production from present crop land plus 300 million new acres land outside tropics[2]	395.5	296.0	35.1	19.4	44.2	211.0	86.1	314.6
Attainable production from all above sources	753.0	535.5	178.1	70.9	56.2	470.0	96.8	323.2
World food needs in 1960	363.5	194.5	33.6	20.4	65.2	411.0	95.8	300.0

[1]Obtained by applying the approximate average production per crop acre in the Philippine Islands to 1,000,000 acres.

[2]Obtained by applying the approximate average production per crop acre in Finland to 300,000,000 acres of Northern Hemisphere soils. Fats and oils and fruits and vegetables are underestimated because Finnish production figures on farm-made butter, meat, fruits, and vegetables were unavailable.

acres of new tropical, and 300 million acres of extra-tropical soils—would exceed world food needs for all classes of food except milk, and pulses and nuts, under the assumptions used, and would exceed them for all classes if a portion of the production of coconuts were shifted from coconut oil to edible nuts. Production of cereals, roots and tubers, sugar, and fats and oils would be far in excess of amounts needed.

To meet world food needs, then, much less than all of these sources of production are required, if efforts were made to produce primarily those classes of foods in deficit.

World Fertilizer Supply

In discussing potential world food production either through intensified farming of old land or by developing new areas, there is one over-lying factor affecting both. Greatly increased quantities of fertilizer will be required. The question arises, then—how adequate are world supplies of fertilizers?

Since nitrogen fertilizer can be manufactured by fixation of nitrogen from the atmosphere, world supplies are limited only by capacity of plants to produce. This plant capacity was expanded greatly in the last decade, because nitrates are a necessity of war.

With phosphate and potash, on the other hand, we must depend on natural deposits to fill world needs. In Table IV we compare known phosphate and potash supplies with potential needs for meeting world food goals. Again it is necessary to make several assumptions. First, we assume that present world crop land would scarcely need a heavier rate of applications than now used in France. You will note that the rate of fertilization in France is several times the present world rate. Second, we assume that the additional billion acres of tropical soils would scarcely need heavier applications than the rate in Hawaii, which is among the highest for all tropical areas. Third, we assume that the 300,000,000 acres of extra-tropical soils will again need no heavier rate of application than that of France. Thus, in all three areas we have chosen countries for comparative purposes which use fertilizer at a relatively high rate so that the estimate on world reserves is conservative.

The resulting amounts of fertilizer used under these conditions would be about eight times the present consumption of phosphate, and nearly 18 time the present consumption of potash. Even so, the known world reserves of phosphate would last more than 5,000 years and the known reserve gf potash 500 years. The world has not been thoroughly explored for these minerals. Doubtless actual reserves exceed known reserves greatly. There are also many sources of potash, other than those included in the known reserves, that may be developed when economical methods of extraction are devised. This latter point again emphasizes how conservative these estimates are, for no allowance was made for technical improvements in the fertilizer industry.

Here, then, is an affirmative answer to the question: Do we have the natural resources to meet world food goals by 1960? This answer is a challenge to all men; not to scientists only. For it raises immediately an even more critical question: Can we mobilize these resources to produce the needed food? This question begs many answers, because it involves the whole field of human relationships.

Science may discover and point the way—but it cannot dictate. The full measure of success in economic, social, and political action comes only with the will of the majority—not from the desire of one group.

If the people of the world really have the determination to give battle to the problem of hunger, if they are willing to extend a small part of the energy and capital poured into World War II, then can we hope for victory.

TABLE IV

FERTILIZER IN RELATION TO EXPANDED FOOD PRODUCTION[1]

Rate of Fertilizer Use in Kg per Hectare of Land Used for Crops:

	P_2O_5	K_2O
World	5.0	3.2
United States	4.9	2.6
France	17.1	12.7
Hawaii	41.0	80.0

World Annual Requirement of Fertilizer Under Expanded Food Production:

	P_2O_5 (metric tons)	K_2O (metric tons)
On 1,940,000,000 acres existing crop land at rate of France	13,425,000	9,970,000
On 1,000,000,000 acres (new) tropical soils at rate of Hawaii	16,400,000	32,000,000
On 300,000 000 new acres extra-tropical soils at rate of France	2,000 000	1,500 000
Total	31,825 000	43,470 000

	P_2O_5 (Billion metric tons)	K_2O (Billion metric tons)
Known world reserves	166	22.5
	(years)	(years)
Years' supply will last under expanded food production	5,200	500

[1]Data on fertilizer use from USDA Misc. Pub. 593.

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- U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
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